x. The Commission also asked for methods of estimating pointing error for purposes of revising the antenna gain pattern rules.[40] Although Hughes limited its proposal to the Ku-band, the Commission invited comment on revising the antenna gain pattern envelope for both C-band and Ku-band earth stations.[41]

17. *Pleadings.* As an alternative to the Commission's proposal in the *Further Notice*, SIA suggests an entirely different approach.[42] First, SIA would start the Ku-band antenna gain pattern envelope at 1.5° off-axis.[43] Thus, SIA would treat Ku-band earth stations routinely if they intersect the antenna gain pattern envelope at 1.5° off-axis or less.[44] Second, SIA defines a new term called the "maximum allowable pointing error." To calculate the maximum allowable pointing error, SIA starts with the antenna gain pattern envelope in Section 25.209(a). According to SIA, a typical earth station has a topocentric angle of 2.1° when looking at a satellite that is 2° away from the target satellite. SIA asserts that the antenna gain pattern envelope allows 20.94 dBi at an off-axis angle of 2.1°.[45] SIA takes a number of antenna gain patterns, and shifts them until the edge of the main lobe is equal to 20.94 dBi at an off-axis angle equal to 2.1°. SIA defines the shifted angle as the maximum allowable pointing error.[46] Finally, SIA plots the starting points of antenna gain envelopes, and the maximum allowable pointing error, for four sub-meter antennas.[47] According to SIA, these points approximate the function "$y = 2 - x$", where y is the maximum allowable pointing error, and x is the starting point of the antenna gain pattern envelope between 1.5° and 1.8° off-axis.[48] SIA states that focusing on the antenna gain pattern envelope

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[40] *Further Notice*, 17 FCC Rcd at 18603 (para. 41).

[41] *Further Notice*, 17 FCC Rcd at 18602 (para. 38).

[42] In the *Fifth Report and Order*, the Commission adopts streamlined procedures for non-routine earth stations. SIA's proposals could also be interpreted as alternatives to the procedures adopted in the *Fifth Report and Order*, in that SIA would create different classes of routine earth stations, and adopt different information requirements for each class. In particular, SIA would classify as routine both earth stations that intersect the antenna gain pattern envelope at an angle less than 1.5° off-axis, and at angles between 1.5° and 1.8° off-axis, provided that applicants that intersect the antenna gain pattern between 1.5° and 1.8° off-axis submit an additional showing, demonstrating the antenna's pointing accuracy. Even though this additional requirement appears analogous to a procedure for non-routine earth stations, SIA makes clear that it classifies earth stations that can make this showing as routine. SIA Further Comments at 24. *See also* SIA February 1, 2005 *Ex Parte* Statement at 1-2 (claiming that its proposals would streamline the earth station procedure by defining more earth stations as "routine.") Accordingly, the Commission decided to treat this SIA proposal as an antenna gain pattern issue here rather than as a non-routine earth station issue in the *Fifth Report and Order*.

[43] We address SIA's proposals for C-band earth stations below.

[44] SIA Further Comments at 8; SIA October 3, 2003 *Ex Parte* Statement at 4, SIA February 1, 2005 *Ex Parte* Statement at Att. In other words, SIA would consider an earth station routine if it started to comply with the antenna gain pattern envelope at an off-axis angle less than 1.5° off-axis, and at all angles greater than 1.5° off-axis.

[45] $29 - 25\log(2.1) = 20.94$. SIA Further Comments at 9-10. The "topocentric" angle is the angle measured from the earth's surface. We discuss the distinction between topocentric and geocentric angles further below.

[46] SIA Further Comments at 9-10.

[47] SIA Further Comments at 10-12.

[48] SIA Further Comments at 11-12.

between 1.5° and 1.8° off-axis is consistent with its proposal in its December 10, 2001 *ex parte* statement but otherwise does not provide any rationale for this proposal.[49] SIA maintains that Ku-band earth station applicants proposing antennas that intersect the antenna gain pattern envelope between 1.5° and 1.8° off-axis should be required to provide a technical showing that the installed antenna will meet the maximum allowable pointing error at the angle at which the antenna's antenna gain pattern intersects the envelope in Section 25.209.[50] SIA recommends basing this technical showing on the earth station antenna cross-polarization null at the antenna boresight direction, because the earth station installation process relies on the cross-polarization null to center the antenna accurately.[51] Alternatively, SIA suggests requiring Ku-band earth station applicants to submit coordination agreements, but not granting ALSAT authority to such earth stations.[52]

18. Originally, SIA asked the Commission to deny applications for earth stations intersecting the antenna gain pattern envelope greater than 1.8° off-axis,[53] but later stated that it would consider such applications for Ku-band antennas if they were coordinated with adjacent satellite operations at 2° away from the target satellite.[54] Aloha Networks criticizes SIA's approach because it does not address antenna movement after installation, due to wind or other factors.[55]

19. Spacenet supports the Commission's proposal to increase the starting angle for the antenna gain pattern envelope, and to consider pointing error in its determinations.[56] Spacenet also argues that SIA's proposals are "unworkable and would undermine the streamlining goals of this proceeding."[57] However, Spacenet contends that the angle between two satellites 2° apart is 2.2° when measured from the earth's surface.[58] Therefore, Spacenet recommends starting the antenna gain pattern envelope at 1.8

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[49] SIA Further Comments at 11, *citing* SIA December 10, 2001 *Ex Parte* Statement.

[50] SIA Further Comments at 12. *See also* SIA March 23, 2004 *Ex Parte* Statement at 2 and Annex; SIA February 1, 2005 *Ex Parte* Statement at Att.

[51] SIA Further Comments at 13.

[52] SIA Further Comments at 13. *See also* SIA October 3, 2003 *Ex Parte* Statement at 5-6; SIA February 1, 2005 *Ex Parte* Statement at Att.

[53] SIA Further Comments at 12.

[54] SIA March 23, 2004 *Ex Parte* Statement at 2.

[55] Aloha Networks May 12, 2004 *Ex Parte* Statement at 2.

[56] Spacenet Further Comments at 7-8.

[57] Spacenet Further Comments at 7.

[58] Spacenet Further Comments at 7 and Att. A at 27. *See also Further Notice*, 17 FCC Rcd at 18599-18600 (para. 32), *citing* Spacenet Comments at 12-14; Spacenet Reply at 7-8. In the *Further Notice*, the Commission explained that the angles between GSO satellites is usually expressed as the "geocentric" angle, *i.e.* measured from the center of the earth, and so is different from the angle as measured from an earth station on the earth's surface, which is defined as the "topocentric" angle. *Further Notice*, 17 FCC Rcd at 18600 n.78. In addition, the Commission found in the *Further Notice* that Spacenet's assumption regarding a 2.2° topocentric angle is not true for most of the United States outside of New England, and so would be likely to result in harmful interference in a 2° spacing environment. *Further Notice*, 17 FCC Rcd at 18640-41 (App. B).

off-axis.[59] According to Spacenet, its proposal allows for a 0.4° pointing error.[60] Spacenet considers this to be a conservative estimate because VSAT licensees can generally achieve a pointing error within 0.4° because of the steep cross-polarization null in most sub-meter antennas.[61] Spacenet further argues that the Commission has licensed several earth stations that meet the antenna gain pattern envelope starting at 1.8° off-axis.[62] According to SIA, pointing accuracy is routinely within 0.5°.[63]

20. Telesat maintains that measuring the angular installation pointing error is not practical.[64] Telesat contends that a pointing error of 0.5 dB is achievable.[65] Telesat argues that the technical information provided in SIA's comments support starting the Ku-band antenna gain pattern envelope at 1.5° off-axis, but recommends that this should be the starting point for the antenna gain pattern envelope in all frequency bands.[66] Telesat argues that there is no reason to have a different starting point for different frequency bands.[67] Spacenet states that the antenna gain pattern envelope for sub-meter Ka-band and Ku-band antennas should begin at the same point.[68]

21. As an alternative to SIA's proposal, Spacenet recommends requiring applicants planning to use antennas that intersect the antenna gain pattern envelope between 1.5° and 1.8° off-axis to certify that they will achieve sufficient pointing accuracy and that their wider main beam will not cause harmful interference. Otherwise, according to Spacenet, SIA's proposal to require coordination is unreasonably burdensome to VSAT operators, and its proposal to require a technical demonstration could require VSAT operators to disclose proprietary data regarding their antenna installation practices.[69]

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[59] Spacenet Further Comments at 8.

[60] Spacenet Further Comments at 8.

[61] Spacenet Further Comments at 8 and Att. A at 26-28.

[62] Spacenet Further Comments at 8-9. Spacenet cites earth stations with the call signs of E000035 and E000132, licensed to Spacenet, and E000166 and E970067, licensed to Hughes. Spacenet Further Comments at 8 n.9.

[63] SIA Further Comments at 7-8.

[64] Telesat Further Reply at 3.

[65] Telesat Further Reply at 3.

[66] Telesat Further Reply at 2.

[67] Telesat Further Reply at 2. Telesat also asserts that, as an alternative to SIA's recommendation, applicants proposing antennas with diameters less than 3.0 meters in the 6 GHz band, 1.2 meters in the 14 GHz band, and 0.6 meters in the 30 GHz band, should either certify that they meet the antenna gain pattern envelope starting at 1.5° off-axis, or demonstrate that their earth stations will not cause unacceptable interference by either providing evidence of coordination agreements or lowering earth station power levels. Telesat Further Reply at 2-3. Because we propose off-axis EIRP envelopes below, we will not address minimum routine antenna size issues at this time.

[68] Spacenet Further Comments at 7 n.7. Spacenet does not address the antenna gain pattern envelope for C-band earth stations.

[69] Spacenet Further Reply at 6-7.

22. *Discussion.* We revise our rules to begin the Ku-band antenna gain pattern envelope at 1.5° off-axis, instead of the current 1.25°. Spacenet and SIA argue that VSAT licensees can generally achieve a pointing error of 0.4° and 0.5°, respectively.[70] While this suggests starting the Ku-band antenna gain pattern envelope at 1.4° or 1.3° off-axis,[71] other commenters support starting the Ku-band antenna gain pattern envelope at 1.5° off-axis.[72] We adopt the 1.5° proposal. We base this decision in part on Spacenet's observation that the Commission has licensed a number of sub-meter earth station antennas in the past, and that those antennas intersect the antenna gain pattern envelope at 1.5° off-axis or less.[73] In addition, we note that the difference between geocentric and topocentric angles provides an additional safeguard against harmful interference to adjacent satellites. Satellites in the GSO orbital plane are generally spaced 2° apart, measured from the center of the earth. This angle is called the geocentric angle. The angle between two satellites viewed from an earth station located on the surface of the Earth is called the topocentric angle. The topocentric angle is always greater than the geocentric angle. At latitudes within the United States, the topocentric angle between two degree separated satellites is usually between 2.1° and 2.2°, depending on the earth station's angle of elevation.[74] Because Commission rules require that space stations be designed to be capable of maintaining orbital longitude within 0.05° of their assigned orbital location,[75] adjacent satellites at closest approach would be separated by at least a 2° topocentric angle. Thus, setting the starting point of the antenna gain pattern envelope at 1.5° off-axis will limit potential interference into 2° separated satellites, and adequately account for potential pointing error of those earth station facilities.

23. SIA and Spacenet would treat Ku-band earth stations routinely if they intersect the antenna gain pattern envelope at 1.5° off-axis or less. This is consistent with the new antenna gain pattern rules we adopt here. However, these commenters would require applicants for Ku-band earth stations that intersect the antenna gain pattern envelope between 1.5° and 1.8° off-axis to provide a specific technical demonstration that its pointing error will be less than SIA's proposed maximum allowable pointing error, or show that it has coordinated its operations.[76] We agree that many of those earth stations warrant

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[70] Spacenet Further Comments at 8 and Att. A at 26-28; SIA Further Comments at 7-8.

[71] In the *Further Notice*, the Commission found that it could start the antenna gain pattern envelope at 1.8° off-axis, but only if there were no possibility of pointing error. *Further Notice*, 17 FCC Rcd at 18602 (para. 39). The Commission explained further, however, that it must take the potential for pointing error into account. Therefore, the Commission invited comment on methods for estimating the average pointing error of an average earth station antenna. The Commission also stated that it would start the antenna gain pattern envelope at "1.8° - x", where "x" represents that average pointing error. *Further Notice*, 17 FCC Rcd at 18602-03 (paras. 40-41). Thus, estimates of pointing error of 0.4° or 0.5° suggest that we start the antenna gain pattern envelope at 1.4° or 1.3° off-axis, respectively.

[72] SIA Further Comments at 11-12; Telesat Further Reply at 2. *See also* PanAmSat November 19, 2004 *Ex Parte* Statement (providing an example of an earth station that intersects the antenna gain pattern at 1.7° off-axis. According to PanAmSat, starting the antenna gain pattern envelope at 1.7° off-axis does not by itself adequately account for the possibility of pointing error.

[73] *See* Spacenet Further Comments at 8-9.

[74] *Further Notice*, 17 FCC Rcd at 18640-41 (App. B).

[75] 47 C.F.R. § 25.210(j).

[76] SIA Further Comments at 13. As noted above, SIA has revised its original proposal. SIA would license earth stations whose antennas intersect the antenna gain pattern envelope at an off-axis angle greater than 1.8° off axis, but only if the earth station operations are coordinated with adjacent satellite operators. SIA March 23, 2004 *Ex Parte* Statement at 2.

licensing, and in the *Fifth Report and Order*, we adopted streamlined procedures to license antennas that intersect the earth station antenna gain pattern envelope at more than 1.5° off-axis.[77] Specifically, we adopted a coordination procedure, and a procedure under which the earth station applicant would reduce its power levels so that the earth station appears like a routine earth station to adjacent satellites. Under the Commission's streamlined approach for non-routine earth station applications, earth station applicants would be allowed to choose either the coordination procedure or the power reduction procedure. In light of the streamlined procedures adopted in the *Fifth Report and Order*, we find that requiring a complex showing of minimum pointing error is unnecessary.

24. Moreover, we conclude that the streamlined non-routine earth station procedures adopted in the *Fifth Report and Order* are preferable to the proposal to prohibit non-routine earth station operators from using the power reduction procedure unless they also coordinate their operations with adjacent satellite operators.[78] The power reduction procedure and the coordination procedure are each in themselves adequate to prevent harmful interference to adjacent satellite operators, and so proposals to require both are unnecessarily burdensome to earth station operators. We have also decided not to require earth station operators not eligible for routine processing to make the technical showing proposed by one of the commenters,[79] and described above. While that proposed technical showing is probably easier for earth station applicants than the technical analysis required before the *Fifth Report and Order*, it would be more difficult than the power reduction procedure that we adopted in that Order that serves the same purpose.[80]

25. We also will start the antenna gain pattern envelope at 1.5° off-axis in the C-band.[81] We agree with Telesat that technical information provided in SIA's comments support starting the antenna gain pattern envelope at 1.5° off-axis, and that there is no basis in the record for adopting a different starting point for different frequency bands.[82] Finally, we will not adopt Telesat's proposed Ka-band

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77 *See Fifth Report and Order* at paras. 36-52.

78 SIA Further Comments at 23; SIA March 23, 2004 *Ex Parte* Statement at 3.

79 *See* SIA Further Comments, App. A at 22-23; SIA March 23, 2004 *Ex Parte* Statement at 2.

80 SIA claims that its proposals constitute streamlining in part because SIA would classify as routine earth station applications that include its proposed minimum allowable pointing error showing. SIA February 1, 2005 *Ex Parte* Statement at 1-2. We find that merely labeling such applications as "routine" does not affect the burdens associated with SIA's proposed minimum allowable pointing error showing. SIA also proposes to revise Section 25.212 of the Commission's rules to cross-reference its proposed antenna gain pattern revisions discussed here. SIA December 10, 2001 *Ex Parte* Statement, App. at 16-17. Because we have decided not to adopt SIA's antenna gain pattern proposals, we need not reach the issue of SIA's proposal to revise Section 25.212 to be consistent with those antenna gain pattern revisions.

81 Telesat Further Reply at 2.

82 Telesat Further Reply at 2. As we noted above, the Commission initially started the antenna gain pattern envelope at 1.0° off-axis for both C-band and Ku-band earth station antennas. In 1993, the Commission revised the Ku-band earth station antenna gain pattern envelope to start at 1.25° off-axis, based on Advisory Committee recommendations. *Ku-band Antenna Gain Pattern Revision Order*, 8 FCC Rcd at 1322 (paras. 38-39). It appears that the Commission did not make similar revisions to the C-band earth station antenna gain pattern envelope simply because the Advisory Committee did not address that issue, not that there was evidence in the record that weighed against starting the C-band earth station antenna gain pattern envelope at 1.25° off-axis. *See also Further Notice*, 17 FCC Rcd at 18597 (para. 25) (proposing revisions to the C-band antenna gain pattern envelope to make it start at the same off-axis angle as the Ku-band earth station antenna gain pattern envelope).

antenna gain pattern starting point, because those earth station antennas are already adequately regulated by the off-axis EIRP envelope in Section 25.138, as SIA notes.

3. Antenna Pointing Accuracy

26. *Background.* Prior to the *Further Notice*, PanAmSat filed an *ex parte* statement advocating a number of measures to prevent or limit earth station antenna pointing error.[83] In particular, PanAmSat asks us to adopt rules requiring the following: (1) a pilot tone, under which the satellite would transmit a signal to the earth station, and the earth station would be precluded from transmitting if the received satellite signal level were to drop below some threshold downlink power level;[84] (2) professional installation for smaller-than-routine C-band and Ku-band antennas;[85] and (3) an automatic transmitter identification system (ATIS) for smaller-than-routine C-band and Ku-band antennas.[86] The Commission invited comment on whether such measures would be necessary, in the event that it revises the antenna gain pattern starting point as we did above.[87]

27. *Discussion.* Spacenet argues that pointing error has not been a serious problem in the past, and there is no reason to assume that it will be in the future. Spacenet also notes that the Commission's rules require licensees to maintain control over their earth station facilities, and prohibit earth stations from transmitting to a satellite unless authorized by the satellite licensee. Spacenet asserts that these rules adequately prevent pointing error.[88] According to Spacenet, PanAmSat based its recommendations on an incorrect assumption regarding VSAT operators' general practices when installing their remote antennas.[89] Spacenet maintains that the proposals in the *Further Notice* amount to micromanaging VSAT operators.[90]

28. As discussed further below, based on commenters' recommendations, we require VSAT system operators to design remote terminals to stop transmission when synchronization fails. We find that, by beginning the antenna gain pattern envelope at 1.5° off-axis, we have accounted for the possibility of pointing error sufficiently that no other pointing error requirements are needed at this time.

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[83] Letter from Joseph A. Godles, Attorney for PanAmSat Corporation, to Magalie Roman Salas, Secretary, FCC (dated Oct. 22, 2001) (PanAmSat October 22, 2001 *Ex Parte* Statement).

[84] *Further Notice*, 17 FCC Rcd at 18604-05 (paras. 46-48).

[85] *Further Notice*, 17 FCC Rcd at 18605 (para. 49).

[86] *Further Notice*, 17 FCC Rcd at 18605-06 (paras. 50-52).

[87] *Further Notice*, 17 FCC Rcd at 18604 (para. 44).

[88] Spacenet Further Comments at 9, *citing* 47 C.F.R. §§ 25.271(c), 25.272(d), 25.273(a), and 25.274.

[89] Spacenet Further Comments at 10. Specifically, Spacenet argues that its remote antennas have a steep null coincident with the co-polarization peak. Spacenet states further that, when it installs its antennas, it measures the remote antenna cross-polarization gain, and minimizes this to align the null with the desired satellite and polarization. Spacenet Further Comments at 10 n.12.

[90] Spacenet Further Comments at 10-14.

Therefore, for the reasons discussed below, we reject all the pointing error proposals in the *Further Notice*.[91]

a. Pilot Tone

29. *Background.* Aloha Networks recommends adopting a pilot tone requirement. According to Aloha Networks, when VSAT network operators deploy remote terminals with small antennas, pointing errors can become more significant.[92] Aloha Networks asserts that this requirement may not be necessary for two-way consumer Internet VSAT systems, however, because many of those systems require the signal to maintain synchronization for internal networking operation, and could achieve the same goal as a pilot tone by configuring the system to cease transmission when synchronization fails.[93] In addition, Aloha Networks argues that VSAT network operators should not be required to monitor their networks if they show that their emissions' power is "much lower" than the off-axis EIRP emissions allowed by Part 25.[94]

30. SIA opposes pilot tones as expensive, an inefficient use of spectrum in VSAT networks, and as duplicative of the outroute signal used to ensure that remote terminals cease transmission when they are improperly pointed.[95] Aloha Networks replies that there should be some automatic monitoring function, regardless of whether that function is based on measuring pilot tones at the remote terminal or measuring transmissions from remote terminals at the hub.[96]

31. *Discussion.* We agree with SIA that a pilot tone requirement for VSAT networks is not necessary. Both Aloha Networks and SIA argue that it is important to design remote terminals to stop transmission when synchronization fails.[97] Because there is a consensus for this alternative to a pilot tone, and the alternative achieves the same purpose but is less burdensome than a pilot tone requirement, we adopt this alternative. Specifically, we require VSAT network operators to employ some reasonable method of their choice to ensure that transmissions stop when synchronization fails.

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91 *Further Notice*, 17 FCC Rcd at 18603-06 (paras. 42-52). As another alternative to these pointing error proposals, SIA recommends revisions to the interference resolution procedures. SIA Further Comments at 16-17. We address SIA's proposal in Section III.A.3.d. of this Order, below.

92 Aloha Networks Further Comments at 6-7.

93 Aloha Networks Further Comments at 7-8.

94 Aloha Networks November 14, 2003 *Ex Parte* Statement. Later, Aloha Networks explained that it would limit the probability of some number of simultaneous 10-millisecond transmissions to 1.0 percent of the time, and the probability of some number of simultaneous 100-millisecond transmissions to 0.1 percent of the time. Aloha Networks would then limit the EIRP spectral density to 8.6 dBW/4 kHz, minus an amount of power sufficient to ensure that the number of permitted simultaneous transmissions do not cause the EIRP spectral density to exceed 8.6 dBW/4 kHz more than 1.0 percent or 0.1 percent of the time, respectively.

95 SIA Further Comments at 13-14; SIA Further Reply at 9-10. *See also* Spacenet Further Comments at 10-11; Telesat Further Reply at 3-4.

96 Aloha Networks Further Reply at 6-7.

97 Aloha Networks Further Comments at 7-8; SIA Further Comments at 13-14; SIA Further Reply at 9-10.

b. Professional Installation

32. *Background.* Aloha Networks argues that professional installation is expensive, and should be required only for VSAT systems that are unable to monitor the pointing accuracy of their earth stations, and operating at or near certain thresholds that Aloha Networks does not discuss further.[98] SIA and Spacenet argue that it is expensive to require all small antennas to be installed professionally, and that, in cases where we believe professional installation is warranted, we can add a license condition to that effect.[99] Telesat asserts that VSAT operators have strong economic incentives to ensure that antennas are installed properly, and so a professional installation requirement is unnecessary.[100] Aloha Networks recommends adopting a rule specifying when professional installation will be required, rather than adopting a requirement on a case-by-case basis, to provide regulatory certainty, but does not offer an opinion on what that rule should require.[101]

33. *Discussion.* We will not adopt a professional installation requirement at this time. In the past, the Commission has adopted professional installation requirements on a case-by-case basis as a condition on "blanket" earth station licenses covering large numbers of technically identical VSAT terminals. However, none of the commenters have provided an adequate basis to impose a professional installation requirement on all blanket earth station licensees, or on all licensees using antennas that are smaller than a certain size. Moreover, nothing in the record provides a basis for crafting a rule that will properly limit the professional installation to those cases where such a requirement is warranted. Therefore, we will not adopt a generally applicable professional installation requirement, but instead will continue to impose such a requirement as a license condition on a case-by-case basis.[102]

c. Location Identifier System

34. Since 1991, the Commission has required satellite uplink transmissions carrying uplink broadband video information to use an automatic transmitter identification system (ATIS).[103] Under this requirement, parties transmitting video signals to satellites must include information in the transmissions that identify their source.[104] The Commission adopted this requirement in response to an increase of

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98 Aloha Networks Further Comments at 8-10.

99 SIA Further Comments at 14-15; SIA Further Reply at 10-11; Spacenet Further Comments at 13-14.

100 Telesat Further Reply at 4-5.

101 Aloha Networks Further Reply at 8-9.

102 We note that the Commission raised issues regarding professional installation requirements in another pending notice of proposed rulemaking. Proposed Changes in the Commission's Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields, *Notice of Proposed Rulemaking*, ET Docket No. 03-137, 18 FCC Rcd. 13187 (2003).

103 *Further Notice*, 17 FCC Rcd at 18605 (para. 50), *citing* An Automatic Transmitter Identification System for Radio Transmitting Equipment, *First Report and Order*, GEN Docket No. 86-337, 5 FCC Rcd 3256 (1990) (*ATIS Order*), 47 C.F.R. § 25.281.

104 ATIS transmits an encoded subcarrier message including, at minimum, the earth station's call sign, a telephone number providing immediate access to someone capable of resolving interference problems, and a unique ten-digit serial number. *Further Notice*, 17 FCC Rcd at 18605-06 (para. 50), *citing* 47 C.F.R. § 25.281(d)(3).

harmful interference in the satellite industry, including intentional interference.[105] In the *Further Notice*, the Commission invited comment on adopting an ATIS-like system for non-routine earth stations operating in the conventional C-band or Ku-band.[106] SIA argues that it is expensive to require all small antennas use an ATIS-like system, and questions whether it has been effective in identifying sources of interference.[107] We agree that the benefits of this proposed requirement do not justify its expense. Accordingly, we will not adopt an ATIS requirement for small earth station antennas.[108]

d. Obligations of VSAT Operators Using Smaller-than-Routine Antennas

35. *Background.* As an alternative to the Commission's pointing error proposals discussed above, SIA recommends several revisions to the procedures for resolving harmful interference contained in Section 25.274 of the Commission's rules: (1) require Ku-band VSAT licensees using sub-meter antennas to be able to identify the specific terminal at which each digital transmission originates; (2) require victims of interference to specify the time of day, frequency, and other relevant information of the interference events; and (3) place the burden for resolving the interference on the sub-meter licensee.[109] Telesat supports SIA's proposal in principle, but cautions that, in some cases, the problem may be the result of inadequately designed links by the operator affected by the purported interference.[110]

36. *Discussion.* We find that the current procedures enable licensees to resolve most if not all allegations of harmful interference quickly and easily, including allegations involving non-routine earth stations. Therefore, commenters' proposals for additional procedures for resolving harmful interference claims involving non-routine earth stations should not be needed. Furthermore, under the streamlined procedures for non-routine earth stations that we adopted in the *Fifth Report and Order*, non-routine earth station licensees should not be any more likely to cause harmful interference than other earth station licensees. Under the certification procedure, non-routine operations should be coordinated before the application is filed.[111] Under the alternative power reduction procedure, the non-routine earth station's off-axis EIRP is reduced so that its operations do not affect adjacent satellites any differently than a routine earth station.[112] For these reasons, we do not believe that any revisions to the procedures for resolving interference are warranted.

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105 *Further Notice*, 17 FCC Rcd at 18605 (para. 50), *citing* An Automatic Transmitter Identification System for Radio Transmitting Equipment, *Notice of Proposed Rulemaking and Notice of Inquiry*, GEN Docket No. 86-337, 104 FCC 2d 1256 (1986) (*ATIS Notice*).

106 *Further Notice*, 17 FCC Rcd at 18606 (para. 51).

107 SIA Further Comments at 15-16. *See also* Spacenet Further Comments at 11-12.

108 SIA and Spacenet also claim that the ATIS system was used primarily to prevent "intentional" interference, and that there is no evidence of intentional interference here. SIA Further Comments at 15-16; Spacenet Further Comments at 11-12. SIA and Spacenet are mistaken. At the time the Commission adopted its ATIS requirement, its goal was to reduce all occurrences of interference. In fact, the Commission observed that about 90 percent of the interference events reported in the previous fiscal year was accidental rather than deliberately induced. *See ATIS Order*, 5 FCC Rcd at 3256 (para. 3). Therefore, we place no weight on this part of SIA's and Spacenet's argument.

109 SIA Further Comments at 16-17.

110 Telesat Further Reply at 6.

111 *See Fifth Report and Order* at para. 52.

112 *See Fifth Report and Order* at para. 42.

4. Antenna Gain Pattern Envelope Outside the GSO Orbital Plane

37. *Background.* When viewed from many points on the earth's surface, satellites near each other in the GSO appear to lie approximately in one plane. The Commission's rules contain different antenna gain pattern requirements within the GSO orbital plane and outside the GSO orbital plane.[113] In pleadings in response to the *Notice*, a number of commenters observed that ITU regulations start the antenna gain pattern envelope at 3° off-axis outside the GSO orbital plane.[114] Accordingly, the Commission proposed starting the antenna gain pattern envelope at 3° off-axis outside the GSO orbital plane for Ku-band earth stations, which operate in bands that are not shared with terrestrial services.[115]

38. *Discussion.* SIA supports this proposal,[116] while none oppose it. We adopt this proposal because it will facilitate the development of more advanced elliptical antennas and should not create any additional interference issues.[117] Therefore, we revise our rules to start the antenna gain pattern envelope at 3° off-axis outside the GSO orbital plane for earth stations operating in the conventional Ku-band. We will incorporate this new requirement into the off-axes EIRP envelopes we propose for Ku-band earth stations below.[118]

5. Backlobe Antenna Gain Patterns

39. *Background.* In response to the *Notice*, Hughes recommended increasing the antenna gain limit for conventional Ku-band antennas from – 10 dBi to 0 dBi for off-axis angles greater than 48°.[119] SIA also recommended revising the "backlobe" gain limit from – 10 dBi to 0 dBi, but only for off-axis angles greater than 85°.[120] SIA would also increase the backlobe gain limit for earth stations operating in parts of the Ka-band that are not shared with terrestrial operations.[121] The Commission invited comment

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113 *See* 47 C.F.R. §§ 25.209(a)(2) and (b).

114 *See Further Notice*, 17 FCC Rcd at 18610-11 (paras. 64-65).

115 *See Further Notice*, 17 FCC Rcd at 18610-11 (para. 65).

116 SIA Further Comments at 17.

117 *See Further Notice*, 17 FCC Rcd at 18610 (para. 64).

118 The Commission limited this proposal to the Ku-band earth station antenna gain pattern envelope. *Further Notice*, 17 FCC Rcd at 18610-11 (para. 65). Therefore, we do not adopt any revisions to the starting point for the C-band earth station antenna gain pattern envelope outside the GSO orbital plane at his time, other than starting the envelope at 1.5° off-axis to be consistent with the C-band earth station antenna gain pattern envelope within the GSO orbital plane. In the *Fifth Report and Order*, we adopted a definition for "equivalent antenna diameter" which will facilitate action on elliptical C-band earth station antennas. *See Fifth Report and Order* at para. 141.

119 *See Further Notice*, 17 FCC Rcd at 18611 (para. 67), *citing* Hughes Comments at 11.

120 *See Further Notice*, 17 FCC Rcd at 18611 (para. 66), *citing* SIA November 5, 2001 *Ex Parte* Statement at 12.

121 *See Further Notice*, 17 FCC Rcd at 18611 (para. 66), *citing* SIA November 5, 2001 *Ex Parte* Statement at 12.

on both proposals in the *Further Notice*.[122] The Commission also invited comment on continuing to allow some fraction of the backlobes to exceed this limit by 3 or 6 dB, as is currently provided for in Sections 25.209(a)(1) and 25.209(a)(2).[123] Finally, the Commission proposed increasing the backlobe limit in the unshared portions of the Ka-band, and keeping the current limit in the 18.58-18.8 GHz and 18.8-19.3 GHz bands only until June 8, 2010, when this band will no longer be shared with terrestrial wireless operations.[124]

40. *Discussion.* In response to the *Further Notice*, SIA advocates increasing the backlobe antenna gain limit from -10 dBi to 0 dBi, but only at off-axis angles greater than 85°, and also recommends continuing to allow these to be exceeded by 3 or 6 dB.[125] Telesat supports relaxing the backlobe limit in the Ku-band, but is concerned that relaxing the backlobe limit in other frequency bands may be premature because it claims that an ITU Working Party is studying this issue.[126]

41. Based in part on SIA's recommendation, we increase the backlobe antenna gain limit from -10 dBi to 0 dBi, but only at off-axis angles greater than 85°, and only for the Ku-band and for parts of the Ka-band that are not shared with other services. This deregulatory action should make it easier for earth station operators to obtain licenses, without weakening our protection against harmful interference for services that share the Ka-band with earth station operators. Although Telesat is correct that ITU-R Working Party 4A is considering backlobe requirements, there is nothing in the record that suggests that relaxing the rules before the ITU completes its study would increase the risk of harmful interference to any other operations. Nevertheless, we will monitor ITU Working Party 4A's progress on this issue. If and when the ITU adopts a Recommendation, we will review our backlobe rules to determine what revisions, if any, would be appropriate. We also adopt our proposal to continue to allow the backlobe antenna gain limit to be exceeded by 3 or 6 dB, as is currently permitted by Sections 25.209(a)(1) and (2).

6. Alternative Antenna Gain Pattern Proposals

a. Background

42. In this *Sixth Report and Order*, we adopt new antenna gain pattern requirements for C-band and Ku-band earth stations. As discussed above, starting the antenna gain pattern envelope at a wider off-axis angle allows earth station operators to have wider main beams, which in turn allows them to use smaller diameter antennas.[127] Currently, the smallest antenna we license routinely at C-band is 4.5 meters in diameter, and at Ku-band, 1.2 meters in diameter.[128]

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122 *Further Notice*, 17 FCC Rcd at 18611 (para. 68).

123 *Further Notice*, 17 FCC Rcd at 18611 (para. 68), *citing* 47 C.F.R. §§ 25.209(a)(1), (2). Section 25.209(a)(1) allows 10 percent of the sidelobes at off-axis angles greater than 7.0° to exceed the equation by up to 3 dB. Section 25.209(a)(2) allows 10 percent of the sidelobes at off-axis angles greater than 1.0° off-axis to exceed the equation by up to 6 dB.

124 *Further Notice*, 17 FCC Rcd at 18612 (para. 69).

125 SIA Further Comments at 17, *citing* ITU-R Working Party 4A, Document 4A/TEMP/280.

126 Telesat Further Reply at 5-6.

127 *See* Section III.A.1.

128 Section III.A.1., *citing Notice*, 15 FCC Rcd at 25133 (para. 11).

43. There were two alternatives to the proposals we adopted above presented in the record. These proposals focus on the antenna gain pattern envelope for C-band earth stations, and also include recommended changes in routine antenna size and, in some cases, a suggestion for lowering the permitted power spectral density into the antenna. For the reasons discussed below, we find that neither of those proposals are preferable to the antenna gain pattern revisions we adopt in this *Sixth Report and Order* above.

b. Onsat Proposal

44. In the *Further Notice*, the Commission invited comment on an alternative approach for decreasing the routine antenna size for C-band earth stations, based on a proposal first raised in a waiver request filed by Onsat Network Communications, Inc. (Onsat).[129] In part, Onsat argued that the Commission should process 3.7-meter C-band earth station antennas routinely, because this would be consistent with beginning the C-band antenna gain pattern envelope at 1.25° off-axis. This, in turn, would make our treatment of C-band earth stations consistent with our treatment of Ku-band earth station antennas, in which we adopted rules in 1993 to start the antenna gain pattern envelope at 1.25° off-axis.[130] We decided to start the antenna gain pattern envelope for both C-band and Ku-band earth station antennas at 1.5° off-axis. Thus, Onsat's proposal for a 1.25° off-axis starting point is superceded by the rules we adopt above, and we need not address Onsat's proposal further.

c. SIA Proposal

45. *Background.* SIA recommends starting the C-band antenna gain pattern envelope at 1.7° off-axis.[131] According to SIA, doing so would support a minimum antenna size of 2.4 meters for routine processing in the C-band, but only if the power density into the antenna flange is limited to -12 dBW/4 kHz, down from -2.7 dBW/4 kHz in the current rules.[132] SIA notes that the Commission granted two earth station licenses meeting these criteria in January 2003.[133] SIA contends that such an earth station would meet the antenna gain pattern envelope in Section 25.209, provided that the pointing error is less

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[129] *Further Notice*, 17 FCC Rcd at 18597-98 (paras. 25-27). *See also* Onsat Petition for Waiver to Permit Routine Licensing of 3.7 Meter Transmit and Receive Stations at C-Band, *Order*, 15 FCC Rcd 24488 (Int'l Bur., 2000) (*Onsat Waiver Order*). By "C-band," we mean the 3700-4200 MHz and 5925-6425 MHz frequency bands. The Bureau denied Onsat's waiver petition. This was in part because, even though Onsat requested routine treatment for its 3.7-meter antennas, Onsat planned to operate with a specific satellite. The Bureau found that it could not treat Onsat's antennas routinely because Onsat did not provide sufficient data to show that its antenna would not cause harmful interference if it were granted an ALSAT earth station license. *Onsat Waiver Order*, 15 FCC Rcd at 24491-92 (para. 8). Also, Onsat failed to show that it faced any unusual hardship that would warrant a waiver of the Commission's rules. *Onsat Waiver Order*, 15 FCC Rcd at 24491-92 (para. 8). *See also* 47 C.F.R. § 1.3 (petitioners seeking a waiver must show "good cause"); WAIT Radio v. FCC, 418 F.2d 1153, 1159 (D.C. Cir. 1969) (*WAIT Radio*).

[130] *Onsat Waiver Order*, 15 FCC Rcd at 24489 (para. 4); *Ku-band Antenna Gain Pattern Revision Order*, 8 FCC Rcd at 1322 (paras. 38-39).

[131] SIA Further Comments, App. B at 9; SIA October 3, 2003 *Ex Parte* Statement at 3. *See also* SIA February 1, 2005 *Ex Parte* Statement at Att.

[132] SIA Further Comments at 4-6; SIA October 3, 2003 *Ex Parte* Statement at 2-3.

[133] SIA Further Comments at 5, *citing* Public Notice Report No. SES-00466.

than 0.5 degrees.[134] SIA further recommends requiring 2.4-meter C-band applicants to certify that their pointing error will be 0.5° or less.[135] SIA also emphasizes that the protection from interference should meet current Section 25.209(c).[136]

46. GCI recommends reducing the minimum antenna size for routinely processed C-band earth stations from 4.5 meters to 3.6 meters. GCI claims that it has used such antennas extensively in its network without causing harmful interference.[137] Alternatively, GCI suggests a minimum antenna size of 2.7 meters for routinely processed C-band earth stations, provided that the earth station operator reduce its power by 3 dB. This is because, according to GCI, the first sidelobe of a 2.7-meter antenna is 3 dB above the antenna gain pattern envelope in Section 25.209.[138] SIA asserts that GCI based its analysis on an inferior earth station antenna.[139]

47. *Discussion.* SIA asserts that 2.4 meter antennas in the C-band meet the antenna gain pattern envelope starting at "1.6° or 1.7°" off-axis.[140] If an earth station meets the antenna gain pattern envelope starting at 1.7° off-axis, and there is 0.5° of pointing error, the earth station could exceed the antenna gain pattern envelope at 2.2° off-axis. This would create a substantial risk that a satellite as close as 2° away from the earth station's target satellite could experience harmful interference.[141] Further, as GCI points out, the first sidelobe of some 2.7-meter earth station antennas in the C-band are double that allowed by the antenna gain pattern envelope in Section 25.209.[142] Whether this is an "inferior antenna," as SIA responds, is irrelevant. Treating an earth station application routinely means that the Commission has determined that it is not necessary to conduct a case-specific review of that application. Thus, to extend routine treatment to earth station antennas less than 2.7 meters in diameter, we would need to be certain that such earth stations would be compatible with a 2° orbital spacing environment if they meet all other applicable technical requirements in Part 25, without conducting a case-by-case analysis of each earth station application.[143] Because some earth station antennas less than 2.7 meters in diameter are not 2°

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134 SIA Further Comments at 6.

135 SIA Further Comments at 6.

136 SIA Further Comments at 7.

137 GCI Further Comments at 1-3.

138 GCI Further Comments at 3-4.

139 SIA Further Reply at 4-5.

140 SIA Further Comments at 7.

141 As explained in this Order above and in the *Further Notice*, a topocentric angle (measured from the earth's surface) of 2.2° is equivalent to a geocentric angle (measured from the center of the earth) of 2.0°, in cases where the earth station has an angle of elevation of 35°. *Further Notice*, 17 FCC Rcd at 18640-41 (App. B). The geocentric angle would be greater than 2.0° for earth stations with an angle of elevation less than 35°. ALSAT earth stations are by definition authorized to communicate in the conventional C-band and Ku-band with all U.S.-licensed satellites, and all non- U.S.-licensed satellites on the Permitted List. Thus, practically all ALSAT earth stations are authorized to communicate with one or more satellites that would require them to operate at angles of elevation less than 35°. As of October 1, 2004, 6579 of 6789 C-band earth stations, or about 97 percent, are ALSAT earth stations. Thus, SIA's proposal is inconsistent with the Commission's 2° spacing policy.

142 GCI Further Comments at 3-4.

143 *Notice*, 15 FCC Rcd at 25132 (para. 7); *Further Notice*, 17 FCC Rcd at 18587-88 (para. 3).

orbital spacing compatible, however, we need to conduct a case-by-case analysis of such earth station applications. Thus, we cannot treat sub-2.7-meter earth stations in the C-band routinely.[144]

48. Furthermore, SIA's proposal to begin the C-band antenna gain pattern envelope at 1.7° off-axis is also coupled with a substantial reduction in allowed power spectral density. On balance, we find this proposal more restrictive than the proposal we adopt herein, to begin the C-band antenna gain pattern envelope at 1.5° off-axis. Finally, we will not adopt GCI's proposals because GCI did not provide any technical study to support either of its proposals.

7. Antenna Gain Pattern Conclusions

49. We have decided to begin the antenna gain pattern envelope at 1.5° off-axis within the GSO orbital arc for C-band and Ku-band earth stations, and 3.0° off-axis outside the GSO orbital arc for Ku-band earth stations. We have also decided that the provisions proposed in the *Further Notice* to help reduce pointing error are not needed, but instead we require VSAT network operators to design their networks to stop transmissions when synchronization fails. Finally, we adopt SIA's and Hughes's proposals to increase the Commission's backlobe requirements to 0 dBi for off-axis angles greater than 85°.

50. We will stay the effective date of these requirements, except for the new synchronization requirement, pending resolution of the off-axis EIRP issues discussed below. In the event that we adopt off-axis EIRP envelopes for FSS earth stations, we will base those envelopes on the revised antenna gain pattern requirements we adopt here. In the *Third Further Notice* below, we invite parties to propose new minimum routine antenna sizes based on these revised antenna gain pattern requirements, in the event that we decide not to adopt off-axis EIRP envelopes for FSS earth stations. Such proposals should be supported by adequate technical analyses.

B. VSAT Multiple Access Technique Requirements

1. Background

51. The Commission's rules permit parties to obtain a license for networks comprised of a number of technically identical small aperture antenna earth stations. These networks are referred to as very small aperture terminal (VSAT) networks. VSATs are generally comprised of a hub station transmitting to a satellite, which then transmits the signal to multiple technically identical remote small aperture antennas.[145] The remote antennas can also transmit to the satellite, which then retransmits the signal to the hub station. VSAT networks were originally permitted only in the Ku-band,[146] which is allocated on a primary basis to the fixed satellite service, but have since been allowed in the C-band and Ka-band under certain conditions.[147]

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[144] Moreover, as explained further below, we have decided not to consider changes to the minimum routine earth station antenna size while we are addressing the off-axis EIRP proposals below.

[145] *Notice*, 15 FCC Rcd at 25145 (para. 50), *citing* Routine Licensing of Large Networks of Small Antenna Earth Stations Operating in the 12/14 GHz Frequency Bands, 51 Fed. Reg. 15067 (Apr. 22, 1986) (*1986 VSAT Order*); 47 C.F.R. § 25.134(a).

[146] *See Notice*, 15 FCC Rcd at 25145 (para. 50).

[147] *See* FWCC Request for Declaratory Ruling on Partial-Band Licensing of Earth Stations in the Fixed-Satellite Service that Share Terrestrial Spectrum, *First Report and Order*, IB Docket No. 00-203, 16 FCC Rcd

52. In the *Notice* and the *Further Notice*, the Commission explained that VSAT networks employ a number of techniques to prevent or limit interference among the multiple remote earth stations, and to prevent them from interfering with other adjacent satellite networks.[148] The original VSAT systems used a Single Channel Per Carrier (SCPC) channelization approach, in which each remote earth station was assigned its own block of spectrum. Subsequently, VSAT system operators developed techniques that enabled some remote earth stations to share frequencies. One sharing technique is known as time division multiple access (TDMA). The TDMA technique assigns each remote earth station a different time to transmit and receive information. Another technique is frequency division multiple access (FDMA). The FDMA technique assigns different frequencies or frequency band segments to different remote earth stations. The SCPC described above is an example of the FDMA technique. A third approach, code division multiple access (CDMA), prevents interference between remote earth stations by assigning a different orthogonal digital code to different earth stations.[149] We refer to TDMA, FDMA, and CDMA as "reservation" protocols, because these techniques "reserve" a time, frequency, or code for each transmission in a VSAT network.

53. Before the Commission adopted the *Notice*, Spacenet, Inc. (Spacenet) filed a petition for declaratory ruling that the Commission allow VSAT networks to use an access technique called "slotted Aloha."[150] In this technique, the hub earth station synchronizes all remote VSAT stations so that they transmit only in discrete time slots, like TDMA, typically tens of milliseconds in duration.[151] Unlike TDMA, however, Aloha transmissions are unsynchronized, and two or more remote earth stations are permitted to transmit simultaneously. Aloha relies on the statistical characteristics of unrelated transmissions from different earth stations to limit the number and duration of simultaneous transmissions. Because simultaneous transmissions can occur in VSAT networks using the Aloha random access technique, we refer to Aloha as a "contention" protocol to distinguish it from the more traditional reservation protocols discussed above.

11511 (2001) (*FWCC/Onsat First Report and Order*). Redesignation of the 17.7-19.7 GHz Frequency Band, Blanket Licensing of Satellite Earth Stations in the 17.7-20.2 GHz and 27.5-30.0 GHz Frequency Bands, and the Allocation of Additional Spectrum in the 17.3-17.8 GHz and 24.75-25.25 GHz Frequency Bands for Broadcast Satellite-Service Use, *Report and Order*, IB Docket No. 98-172, 15 FCC Rcd 13430 (2000). We refer to C-band VSAT networks as "CSATs."

148 *Notice,* 15 FCC Rcd at 25145 (para. 50).

149 For a more detailed discussion of each of these techniques, *see Notice,* 15 FCC Rcd at 25206-10 (App. E).

150 Petition of Spacenet, Inc. for a Declaratory Ruling that Section 25.134 of the Commission's Rules Permits VSAT Remote Stations in the Fixed Satellite Service to Use Network Access Schemes that Allow Statistically Infrequent Overlapping Transmissions of Short Duration, or, in the Alternative, For Rulemaking to Amend that Section, *Order*, 15 FCC Rcd 23712 (Int'l Bur., 2000) (*Spacenet Order*). With the "unslotted Aloha" technique, remote earth stations in the VSAT network can transmit randomly at any time, meaning that the transmissions are not synchronized in time or duration. The "unslotted Aloha" technique is distinguishable from the "slotted Aloha" technique, in which remote earth stations transmit in specific time slots, which means that the transmissions are synchronized but not coordinated. In other words, the remote earth stations transmitting in a given time slot can transmit regardless of whether there are other earth stations transmitting in the same time slot. G. Maral, *VSAT Networks* at 144-45 (John Wiley and Sons, ed. 1995); *Spacenet Order,* 15 FCC Rcd at 23713 (para. 3).

151 *Spacenet Order,* 15 FCC Rcd at 23713 (para. 3).

54. When two or more remote earth stations using a contention protocol transmit simultaneously using the maximum allowed EIRP density per carrier, those transmissions can "collide." The resulting power level caused by these collisions at a received satellite exceeds the level specified in the Commission's rules during the time period of simultaneous transmission, although for no more than tens of milliseconds.[152] According to Spacenet, however, because the collisions in its VSAT network are infrequent and of short duration, they do not cause unacceptable interference to adjacent satellite systems.[153] In its petition for declaratory ruling, Spacenet requested that the Bureau conclude that the Commission's rules allow the slotted Aloha technique as a general matter, provided that the VSAT network operator limits the amount of traffic on its network sufficiently to reduce the probability of a collision to an acceptable level.[154]

55. The International Bureau (Bureau) denied Spacenet's petition for declaratory ruling because the power level resulting from transmission signal collisions can exceed the routine processing limits specified in Sections 25.134(a) of the Commission's rules.[155] The Bureau concluded, however, that Spacenet had shown that use of the slotted Aloha method is not currently causing unacceptable interference to other satellite systems. Accordingly, the Bureau granted Spacenet and other VSAT operators that employ various multiple access techniques a waiver of Section 25.134 for purposes of continuing to use existing multiple access methods while this rulemaking is pending.[156] The Bureau noted that its waiver does not prejudge our actions in this rulemaking proceeding.[157]

56. In the *Notice*, the Commission developed its own proposed VSAT multiple access rules. The Commission did not consider the statistical equation that Spacenet recommended in its petition for declaratory ruling, because the Commission believed that a more general and simplified approach addressing several random access techniques would better facilitate the licensing of earth stations than a rule limited to the slotted Aloha technique.[158] Specifically, the Commission invited comment on revising Section 25.134(a) to include the following language: "The maximum transmitter power spectral density of a digital modulated carrier into any GSO FSS earth station antenna shall not exceed -14.0 - 10log(N) dB(W/4 kHz)."[159] Section 25.134(a) would also specify different values of "N" for systems using FDMA, TDMA, CDMA, or Aloha multiple access techniques. Specifically, the Commission proposed setting N equal to 1 for FDMA and TDMA systems, and setting N equal to "the likely maximum number of co-

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152 Spacenet maintained that the duration of an inbound transmission is typically between 15 and 50 milliseconds. *Spacenet Order*, 15 FCC Rcd at 23713 (para. 3), *citing* Spacenet Petition at 8.

153 *See Spacenet Order*, 15 FCC Rcd at 23713 (para. 3).

154 *See Spacenet Order*, 15 FCC Rcd at 23714-15 (para. 7).

155 47 C.F.R. § 25.134(a). *See also Spacenet Order*, 15 FCC Rcd at 23715 (para. 9).

156 *Spacenet Order*, 15 FCC Rcd at 23716 (para.12).

157 *Spacenet Order*, 15 FCC Rcd at 23716 (para.12).

158 *Notice*, 15 FCC Rcd at 25146-47 (para. 54).

159 *See Notice*, 15 FCC Rcd at 25147 (para. 55).